SILVICULTURAL STUDIES
ON THE JACKSON AND COCKERHAM ADDITIONS
TO THE MCDONALD FOREST

by
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INTRODUCTION

In the fall of 1938 the School of Forestry at Oregon State College increased its land holdings by adding 1960.5 acres to the already existing 2,401 acres of McDonald Forest. This increase is the result of the purchase of the Jackson tract, 1160.5 acres, and the Cockerham tract, 800 acres. Both of these tracts are located on the headwaters of Oak Creek in sections 8, 9, 15, 16, 17, 18, 19, and 20 of T11S, R5W, Willamette meridian. Together they make up the west portion of the McDonald Forest.

On this recently acquired addition to the School of Forestry lands no studies have been made up to the present time to analyze the existant forest cover in respect to its condition and extent. Because of this present lack of information on the physical characteristics of the area, it has been impossible to know definitely the maximum silvicultural utility of the land.

In so far as ultimate management of the area studied, as well as the McDonald Forest as a whole, is dependent to a great extent upon the silvicultural values found upon this area; it is evident that a study of these values is necessary. Such a study presented in the form of a plan shall find its place in the future management of the area. It is the object of this study to formulate
such a plan which will aid in the future management of the area.
SILVICULTURAL STUDIES
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As a basis for silvicultural studies of the tract certain physical data must be available to use as a basis for any recommendation that may be made as a result of this study. This data was gathered, compiled, and finally analyzed in its interrelation. These physical data include such information as forest type, soil type, topography, and climate; each of which may in turn be broken down into component parts having varying influences upon the silvicultural capacity of the area.

SITE

Site is that term used by foresters to denote the environment or habitat of any plant association. However, as a silvicultural concept, site is sometimes taken to mean the physical conditions rather than the habitat in which the plants exist. It is this combination of physical data that makes up the site or habitat for any given plot; and it will, then, be the object of direct study.

Because both the kind and quality of vegetation produced on a given area is directly related to those variable factors making up the site, any change in factor influence may in turn cause a change in the amount of material produced. It is, therefore, important that an attempt be made
to weigh each factor carefully when all the factors for any given area are finally studied as that combination of variables, site.

From the above it may be thought that each natural forest type has as its determinants a set of conditions which if duplicated in another locality will in time result in an identical type. Over the long-time period, and with the assurance that all factors can be duplicated, this may be true; but we must recognize our inability to completely control nature and be content with a few silvicultural methods.

How convenient it would be to find a definite correlation between several of the factors or combination of factors to the extent that for anyone type the one determinant can be found which when controlled by itself through silvicultural methods of cutting and stocking will result in the desires of the forester. But, since such a complexity of variables are present, a change in any one of them will bring about complementary changes in the others to the extent that no definite rules of expected behavior can be set down. For that reason observations of present values in the light of past experience can be the only profitable means of making silvicultural recommendations.

Since site, that combination of environmental factors which combine to make up the habitat, is to be the object
of direct study, it is necessary that an inspection be made of its constituents; mainly climatic, edaphic, physiographic, and biotic factors.

Climatic Factors

The climate of the region is characterized by heavy rainfall during the late fall and winter months and hot, dry conditions during the late spring, summer, and early fall. Following is a table showing the rainfall and average temperatures for an average year of the ten-year period, 1929 -- 1938, at Corvallis, Oregon. (U.S.D.A. Weather Bureau)

<table>
<thead>
<tr>
<th>Month</th>
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<td>December</td>
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Edaphic Factors

Of the four factors listed this one is the most complex; due, perhaps, in part to the many variables present, but mostly to the ease with which these variables or their ratio can be changed. Any slight alternation in cover, density of cover, exposure, gradient or any one of the many other variables may effect the soil, and it is turn the vegetative stand.

To a certain extent soil type, as forest type, could be used to differentiate the tract into smaller areas having similar characteristics. From a comparison of site and type maps with that of soil, a slight but nevertheless evident correlation exists. It is more clearly seen when comparisons are made in the field, especially along the creek bottom-land and on the uniform slopes to the west of Oak Creek. Seven recognized soil types are to be found on the tract. (See page II of the appendix)

Rough mountainous country (R) Land falling within this classification is of non-agricultural character and because of this was not mapped in detail; partly due, perhaps, to the limitation of the survey. The soils are of residual origin and are derived either from igneous or sedimentary rocks. Bedrock is encountered at depths of 6 to 36 inches, and detached rock fragments or boulders are numerous on the surface. Rock outcrops are common along the breaks and steeper mountain sides.
**Olympic clay (Oc)** The Olympic clay is a residual soil derived from the weathering of the coarser-grained basic igneous rocks. The surface soil of the Olympic clay is a brown to dark-brown, heavy, plastic clay extending to a depth of 3 to 10 inches. Two layers make up the subsoil -- the upper one is a grayish-brown or drab-color containing numerous rusty-brown or black iron concretions or pellets and partly decayed fragments of the parent rock; the lower, encountered at depths of 16 to 24 inches, is a grayish-yellow or yellow-drab clay boam containing enough partly decayed rock fragments to give it a gravelly texture. The type is generally shallow; the bedrock, reached at depths of 2 to 4 feet, is rarely outcropping. This type has little agricultural value. Scrub oak is found where moisture conditions are favorable, but most of the type supports only a scant growth of grass during the wet season.

**Olympic clay -- shallow phase (Oc)** This phase includes areas in which the bedrock, similar to the more deeply weathered areas, is reached within 6 to 20 inches of the surface. In places protected from the direct rays of the sun the soil supports a scrubby growth of oak. Grass grows well during wet seasons, but dries up in the late spring so that it no longer provides grazing.

**Cove clay (Cc)** The Cove clay consists of 15 to 20 inches of black, dark-gray, or very dark brown clay, underlain by
a black, waxy clay mottled with yellow or rusty brown. The soil is very plastic when wet and has a tendency to puddle if worked when not at proper moisture condition. It is developed principally along the smaller stream channels. Drainage is generally poorly developed both for surface and subsoil.

**Cascade clay loam (Ca)** The surface soil of the Cascade clay loam typically consists of 12 to 14 inches of brown to light-brown clay loam. The subsoil is a yellow or browish-yellow clay loam of compact structure. Bedrock is reached at depths of 4 to 6 feet. Cascade clay loam is a residual soil derived from the soarser grained basic igneous rocks. It occupies the crests of the flat or plateau-like lower hills or areas of gently sloping or rolling topography.

**Wapato silty clay loam (Wc)** The surface soil of the Wapato silty clay loam is a faintly mottled brown, dark-brown, or dark-grayish brown, smooth, heavy silty clay loam 8 to 12 inches deep. The subsoil, to a depth of 36 inches or more is a moderately compact drab or brown clay or clay loam. This soil is an extensive recent-alluvial soil; has an almost level to gently sloping surface, and the drainage is poor. The Wapato silty clay loam is naturally fertile and with drainage could be made productive for agriculture.

**Aiken silty clay loam (Al)** The Aiken silty clay loam is a residual soil derived from the weathering in place and to
some extent from coarser grained basic igneous rocks. In its typical development it consists of 10 to 12 inches of red to brownish-red silty clay loam. The subsoil is red in color, generally of about the same texture or slightly heavier than the soil, and compact. This type occupies gently rolling hilltops and some areas that are nearly level. The drainage everywhere is well developed.

Physiographic Factors

The physiographic features are mainly those that determine form and structure of the land surfaces and the progressive change in these conditions. Those direct factors; earth configuration, altitude, slope, and exposure, can be shown best by a topographic map. The effects, however, must be left for the type and soil maps to show, as these elements are to a great extent governed by the physiographic features; i.e., sheet erosion present on the open hillsides. It is these rapid, progressive changes that show a marked effect on the habitat and the vegetation within it. In general, however, the topography of any given area may be considered stable and must be treated as a constant.

Biotic Factors

The biotic factors relate to those determinants of the habitat which deal with the influences of man and animals. Without exception, the entire tract has been subject to a more or less severe biotic influence during the last thirty
years. Much of the brushland (seedling and sapling type on the type map) is due to logging and subsequent burning of the tract during and immediately after the World War. Other areas still void of tree or brush growth have a grass and weed cover due to the excessive grazing of livestock, especially sheep, on the area. This factor of grazing is still present and has a deteriorating effect upon the possible forest cover.

It can be seen then that the biotic factors in operation on the area have prevented the development of a natural vegetation. They retard, or prevent, the establishment and development of the climatic, climax communities. There is no sharp line of distinction between the influence of man and animals except in man's use of fire, as much of man's influence is exerted through his domestic animals. Both have similar effects which may be listed as follows:

1. Withdrawal of large quantities of plant material.
2. Mechanical injury to plants.
4. Direct effect upon soil formation by stirring action.
FOR FOREST TYPES

For the purpose of this study it was found most convenient to divide the area into units by types and then discuss each in turn. Types seem to be the most ideal for this purpose as they are most easily recognized and differentiable as well as giving an index to the present cover composition. According to a recent timber cruise of the area eleven forest types are present upon the tract. The largest forested acreage is in small second growth having about 700 acres, yet the greater percent of area is non-forested, non-agricultural land as the following summary shows.

Type number 2, 706 acres: non-forest land other than agricultural.

Type number 3, 10 acres: agricultural; cultivated, and cleared pastures on operated farms.

Type number 4, 58 acres: woodland; a forest containing over 60% oaks or madrone.

Type number 7, 7 acres: Douglas fir, small old growth; a forest containing over 60% Douglas fir, 20-40" DBH.

Type number 8, 26 acres: Douglas fir, large second growth; a forest containing over 60% Douglas fir, 20-40" DBH.

Type number 9, 701 acres: Douglas fir, small second growth; a forest containing over 60% Douglas fir, 6-20" DBH.

Type number 10, 16 acres: Douglas fir, seedlings and saplings; a forest containing over 60% Doug. fir 0-6" DBH.
Type number 29, 5 acres: white fir, large; a forest containing over 50% white fir, and over 20" DBH.

Type number 31, 78 acres: hardwoods; alder, maple, ash, and/or cottonwood predominating.

Type number 35, 9 acres: old cut-overs, not restocked; clear cut prior to 1920.

Type number 10-34, 109 acres: Douglas fir, seedlings and saplings; original stand cut prior to 1920.

SILVICULTURAL STUDIES

For the purpose of this work, type was chosen as that unit of study for convenience only; it is admitted that within individual types conditions are existant which would in natural succession tend to further break up the present type areas into smaller units. Yet it is with conditions as they exist today that we must work, and it is with these that we must concern ourselves. Silviculture cannot be the end in forestry anymore than management or utilization. Each must serve the whole and must be economically reasonable over the long-time period; still, some things must be considered as reasonable on lands where the forest is a laboratory for a school, a show room for the state forestry office, and a classroom for the public at large. With these points in mind each or several of the forest types will be examined and discussed in part with the intention of making suggestions based upon personal observations.
Open Grasslands

By far the largest percent of the area studied is classified as non-forest land; that is, non-agricultural and pasture land. Because the bare areas are found almost entirely upon the southerly exposures, one may easily say that excess insolation is the determining factor and dismiss further comment. But, for heat to be truly effective, other items must be in accord with it. On all areas examined the complete lack of forest growth -- and in some cases even scrub oak and perennials -- is due directly to insolation; indirectly to excessive drainage in shallow soils and to a soil whose wilting coefficient is high, 10-14 %. Clay soils such as the Olympic clay (shallow phase) on which this type is largely present is anything but a soil inductive to tree growth. During the recent spring drought of three weeks even the grasses and some perennial weeds dried up before their leaves had completely unfurled. What must be the hardiness of a tree to survive upon such a site?

It has been assumed that the ultimate end of proposed management of the area is to get a forest growth on the entire tract. Whether it will be a productive growth is to be seen. To this end planting of a hardy, drought resisting species is the only solution. Hardy transplant or root pruned stock of pine may be successful using the pine plantation on the Bald Spot as an index. It must be considered, however, that the site is not comparable with that found on
the Bald Spot as far as soil is concerned. There the soil is one of the red hill series, Aiken silty clay loam, which is a deeper soil having a more pervious B horizon. Planting of native oak found upon adjacent areas is also advocated, even more strongly than pine; at least as the initial planting to be followed later by pine under the protecting oaks. No matter what species is planted, planting should not be done with the purpose of establishing a normal evenly spaced stand at once. By using a few indicator plants to point out the deeper soil pockets, cracks in the subsoil, etc. better survival can be expected. The wild cucumber, Echinocystis oreganus, is a very good one as is the wild pea, Vicia americana. Other spots indicated by a weak growth of grass and early perennials must be shunned in planting, for here the parent rock is outcropping or at least close to the surface.

Another portion of this non-forested land is characterized by its presence upon the creek-bottom lands. Here soil type again correlates with forest-land type. Either Wapato silty clay loam or Cove clay may be the soil type; both are heavy, poorly drained soils, are quite shallow, and have poor aeration. Adjacent to the stream alders are abundant, but fifty feet away only scattered oaks and clumps of wild rose are found.

Using a recent Christmas tree plantation as an example the expected survival of Douglas fir is very low. After
three weeks of dry weather only about 30% survival was estimated. The soil which was easily worked when the trees were planted during the winter months was, at the time of the inspection, hard and dry with deep cracks present. Here as before, if a producing tree growth must be had, a three needle pine is perhaps the only species to plant, and they should be planted in shallow pits to insure a better moisture supply during the critical first summer.

It is admitted that the observations have been insufficient as far as the effect of sheep grazing on these open areas is concerned. At least natural succession has been halted; perhaps to the extent of keeping the area a grassland. In several cases browsed fir seedlings were found which may indicate the effect of sheeping the area. But the sharp demarkation between brushland and creek-bottom grassland cannot be contributed to sheep grazing, for it is wholly due to effects of two contrasting soils.

Brushlands

A good portion of the tract studied already has existent plant growth upon it indicating its suitability as forest land even though complete stocking is not present. Forest types 10 and 10-34 as shown on the map and certain areas falling under type 9 are included here. Brushlands was used to denote these areas as the cover is for the great part made up of dense bruch; hazel, ocean spray, G. oak, snowberry, sal-
mon berry, and poison oak predominating. Scattered Douglas fir mostly of the seedling and sapling stage are found, but normality of stocking is sceptically judged to be thirty percent.

Without exception the favorableness of site for Douglas fir is poor, mostly site III and IV. Although poor it is in the process of being built up; and if the presence of hazel is any indication, the succession of plant cover has reached the place where more reproduction of Douglas fir may be expected in the future. The next few years should show a marked increase in the number of seedlings; partly due to the above and partly to the excellent seed crop on the scattered trees this year.

Here as in the grassland types the present cover composition and the expected forest type vary as one passes from one soil type to another. An outstanding example is to be found on the slopes west of Oak Creek. Though the transition is not as a line, it is nevertheless evident; on the lower reaches Olympic clay (shallow) while above it is Olympic clay loam. On the latter the brush is denser, more salmon berry and cascara, and the leader growth on the saplings more luxuriant.

Because a partial stand with reproductive capabilities is already existant, a planting program is not recommended. In its place a stand improvement project may be projected whereby the now open growing trees will be pruned. On poor
sites, especially in the open stands, the lateral branches on Douglas fir are very persistent and form hard, dense wood and persist for 20-30 years after death of the foliage. A low grade of fuel wood is the result.

**Timberlands**

Presenting even a greater problem are those areas already supporting forest types of second growth and small old growth character. These stands, the majority of which are on site III D.F., are not only of poor quality but of very low density, mostly quite low. The stand as it exists is of no value commercially except for fuel wood in the most accessible places. What then must be done to return the productivity of the land to producing quality forest products?

Removal of the present stand by controlled light burning followed by planting would at least place upon the land a stand capable of giving returns at maturity. However, burning cannot be advocated because of its harmful effects upon the site qualities. This land is not far removed from the time when it, too, was bare land, and fire would only reverse the direction of succession by consuming the sparse litter and humus material. It, therefore, is out of question. Clear cutting and planting is economically unsound, and selective cutting on a large scale is highly improbable due to the excessive costs that would be entailed to reach the scattered merchantable trees. Though these methods are not applicable
economically, it is recognized that they are by far the best silvicultural treatment for these type areas.

Forestry, admittedly, is a long-time proposition; and over this long-time period nature is the forester's keepest tool. Because of this it is best that nature be left to utilize the area as best it can and to build up the site quality through progressive succession. The resultant stand at the end of this natural rotation will be a unevenaged one; it may have a mixture of hardwoods and white fir. It will, though, be a desirable stand; being merchantable and becoming increasingly more productive.

It is with hesitation that the conclusions of this study have been pointed toward the fact that the Jackson and Cockerham tracts are both in very poor condition as far as the present forest cover is concerned. Also, that the potential production of forest products on the tracts is equally poor in comparison due to the poor site qualities, especially soil. These facts must be recognized when a program for enhancing the value of the Forest School lands is undertaken.
APPENDIX
Map Showing Location of Area Studied
Soil Map for Area Studied

R Rough mountainous country
Oc Olympic clay
Oc Olympic clay (shallow phase)
We Wapato silty clay loam
O, Olympic clay loam

Ca Cascade clay loam
Cc Cove clay
Al Aiken silty clay loam
Me Melbourne clay loam

Scale: 2” = 1 mi.
Forest Type Map for Area Studied

- Non-forest; non-agricultural
- Agricultural
- Oak-madrone
- D.F. large old growth
- D.F., large old growth
- D.F., small old growth
- D.F., small second growth
- D.F., seedlings & saplings
- White fir, large
- Hardwoods
- Old cutover; non-restocked
- D.F. s+s.; hardwoods
- D.F. s+s.; cut prior to 1920
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